

**What is claimed is:**

1        1. An ESD protection circuit with high substrate-  
2 triggering efficiency comprising:

3              a multi-finger-type device having a plurality of finger  
4              gates below which parasitic BJTs are formed, a  
5              plurality of finger sources, each of which is an  
6              emitter of one of the parasitic BJTs, and at  
7              least one finger drain coupled to a pad;

8              a plurality of voltage drop elements, each of which is  
9              coupled between one of the finger sources and a  
10             power line to detect a transient current flowing  
11             through one of the finger gates; and

12             a plurality of feedback circuits, each of which is  
13             coupled between a base and an emitter  
14             respectively of a first and second parasitic BJT,  
15             and activates the first BJT to bypass ESD current  
16             during an ESD event.

1        2. The ESD protection circuit as claimed in claim 1,  
2 wherein the multi-finger-type device is a multi-finger-type  
3 NMOS.

1        3. The ESD protection circuit as claimed in claim 1,  
2 wherein the multi-finger-type device is a multi-finger-type  
3 PMOS.

1        4. The ESD protection circuit as claimed in claim 1,  
2 wherein one of the finger gates is coupled to the power  
3 line.

1       5. The ESD protection circuit as claimed in claim 4,  
2 wherein one of the finger gates is coupled to the power line  
3 through a resistor.

1       6. The ESD protection circuit as claimed in claim 1,  
2 wherein one of the finger gates is coupled to a pre-driver.

1       7. The ESD protection circuit as claimed in claim 1,  
2 wherein the voltage drop elements are resistors.

1       8. The ESD protection circuit as claimed in claim 7,  
2 wherein the resistors are formed by a well of a first  
3 conductivity in a substrate of a second conductivity.

1       9. The ESD protection circuit as claimed in claim 1,  
2 wherein the voltage drop elements are inductors.

1       10. The ESD protection circuit as claimed in claim 1,  
2 wherein one of the voltage drop elements is a diode.

1       11. The ESD protection circuit as claimed in claim 1,  
2 wherein one of the voltage drop elements is a series of  
3 diodes.

1       12. The ESD protection circuit as claimed in claim 1,  
2 wherein each of the feedback circuits couples the base of  
3 the first parasitic BJT to a collector of the second  
4 parasitic BJT.

1       13. The ESD protection circuit as claimed in claim 1,  
2 wherein each of the feedback circuits couples the base and a

3 collector of the first parasitic BJT, and a collector of the  
4 second parasitic BJT together.

1       14. The ESD protection circuit as claimed in claim 1,  
2 wherein the multi-finger-type device is a stacked MOS.

1       15. An ESD protection circuit with high substrate-  
2 triggering efficiency formed on a substrate of a second  
3 conductivity comprising:

4           a guard ring of the second conductivity formed on the  
5           substrate as a contact region thereof;

6           a plurality of fingers enclosed by the guard ring, each  
7           of which has a finger source formed by a first  
8           doping region of a first conductivity, a finger  
9           drain formed by a second doping region of the  
10          first conductivity and coupled to a pad, a finger  
11          gate between the first and second doping region,  
12          and a substrate current input node formed by a  
13          third doping region of the second conductivity  
14          enclosed by the second doping region, wherein the  
15          first and second doping region, and the proximate  
16          substrate form a parasitic BJT;

17          a plurality of resistors formed by wells, each of which  
18          is coupled between one of the finger sources and  
19          a power line; and

20          internal connection circuits coupling one of the finger  
21          sources to one of the substrate current input  
22          nodes to activate a second parasitic BJT by  
23          current flowing through a first parasitic BJT and

24               one of the resistors coupled thereto during an  
25               ESD event.

1               16. The ESD protection circuit as claimed in claim 15,  
2               wherein each of the resistors is formed by a well of the  
3               second conductivity between the first doping region and a  
4               fourth doping region coupled to the power line.

1               17. The ESD protection circuit as claimed in claim 15,  
2               wherein a field oxide is disposed between the first and  
3               fourth doping region to increase a resistance of the well.

1               18. The ESD protection circuit as claimed in claim 15,  
2               wherein a field oxide is disposed between the second and  
3               third doping region isolating one region from the other.

1               19. The ESD protection circuit as claimed in claim 15,  
2               wherein a dummy gate is disposed between the second and  
3               third doping region isolating one region from the other.